REMARKS

Applicants have considered the outstanding official action. It is respectfully submitted that the claims are directed to patentable subject matter as set forth below.

Initially it is noted that claims 4-6, 13, 14 and 16 are stated to be allowable if rewritten in independent form. Claims 4, 5, 6, 13/12/11/1, 14/1 and 16 have been rewritten in independent form. Claims 14/2/1, 14/3/2/1 and 14/4/2/1 have been added as claims 30, 31 and 32 respectively. Claims 13/12/11/2, 13/12/11/7 and 13/12/11/8 have been added as claims 33, 34 and 35 respectively. Accordingly, claims 4-6, 13, 14, 16 and 30-35 are in condition for allowance. Allowance thereof is respectively requested.

The drawings are objected to in that Figure 1 should be labeled "Prior Art" and as failing to comply with 37 CFR 1.84(p)(5) in that the reference sign 54 mentioned in the specification at page 22, line 31, is not shown. Applicants are submitting herewith a proposed corrected Figure 1 including the legend "PRIOR ART" shown in red and a

proposed corrected Figure 9b showing reference "54" in red. Approval of the proposed corrections is requested.

The informalities in the specification noted by the Examiner have been corrected.

The outstanding rejections based on art are as follows:

(1) Claims 1-3, 7, 8, 10, 18 and 21 under 35 U.S.C. §102(b) as anticipated by WO 99/17883 (Tai);

(2) Claims 1, 15, 17 and 18 under 35 U.S.C. §102(b) as anticipated by WO 98/04355 (Pethig '355);

(3) Claims 1, 15 and 18-21 under 35 U.S.C. §102(b) as anticipated by "Electromanipulation and separation of cells using travelling electric fields", J. Phys. D. Appl. Phys., vol. 29, pp. 2198-2203 (1996) (hereinafter "Talary");

(4) Claims 1, 10-12, 15 and 18-25 under 35 U.S.C. §102(b) as anticipated by U.S. Patent No 5,858,192 (Becker);

(5) Claims 1, 7-10, 15 and 18 under 35 U.S.C. §102(b) as anticipated by WO 97/34689 (Pethig '689);

(6) Claims 1-3, 7-10 and 17-26 under 35 U.S.C. §103(a) as unpatentable over Tai;

(7) Claims 1, 15 and 17-26 under 35 U.S.C. §103(a) as unpatentable over Pethig '355;

(8) Claims 1, 15 and 17-26 under 35 U.S.C. §103(a) as unpatentable over Talary;

(9) Claims 1, 10-12, 15 and 17-26 under 35 U.S.C. §103(a) as unpatentable over Becker; and

(10) Claims 1, 7-10, 15 and 17-26 under 35 U.S.C. §103(a) as unpatentable over Pethig '689.

Applicants initially note that independent claims 1 and 18 have been amended to provide that inter-electrode spacing variation gives rise to at least one particle channel. This feature is not taught or suggested by the applied art. Applicants respectfully submit, therefore, that the applied art does not teach or suggest each and every element as claimed and therefore does not anticipate or render obvious the claimed invention within the meaning of 35 U.S.C. §102 or §103. The applied references which are each applied individually, are more particularly discussed below.

With respect to Tai, Tai teaches the electrostatic transportation of particles (EPT), whereas the claimed invention is directed to dielectrophoretic transportation of particles. Thus, Tai does not teach the claimed

dielectrophoretic cell and dielectrophoretic method. Tai and the claimed invention involve two different phenomena.

The physical principle of the method utilized in Tai is described in the paper by Moesner and Higuchi cited in Tai on page 2, lines 9-11. The paper by Moesner and Higuchi entitled "Electrostatic Devices for Particle Microhandling" published in IEEE Transactions on Industry Applications, vol. 35, pages 530-536, 1999, teaches that insulating film covering a plurality of electrodes becomes charged by triboelectrification. When the dynamic forces of the electric field overcome adhesion and gravitational forces, the particles move synchronously with the phase of the applied traveling field. Large voltages are required (e.g. claim 12 of Tai claims 100V). The main novelty taught in Tai is control of the vertical height of the particle above the electrodes by an appropriate choice of thickness of the insulation film covering the electrodes (page 10, lines 23-31). The insulating film is required in order to protect the particles against electrical discharges (page 530 in the paper by Moesner and Higuchi).

Applicants' claimed invention concerns the transport of particles by traveling wave dielectrophoresis (twDEP). Three aspects of twDEP relevant to recognizing the

distinction between the teachings of Tai and the claimed invention are namely:

1. Dielectrophoretic (DEP) transport occurs as a result of a dipole moment being induced in the particles and not as a result of triboeletrofication (as for EPT described in Tai);

2. The twDEP force propels the particles in the opposite direction to the moving electric field vector (i.e., asynchronously with the phase, not synchronously as for EPT); and

3. The twDEP motion of particles occurs over only a narrow frequency range, determined by an imaginary (out-of-phase) component of the induced dipole having a sufficiently large value, and a real (in-phase) component being negative so as to levitate the particles above the electrode plane. (The levitation height is controlled by the magnitude of the negative DEP force and not by the thickness of an insulating layer covering the electrodes as for EPT. In fact, covering the electrodes with an insulator seriously degrades the DEP effect).

Further, a significant practical consequence arising from the difference in physical principles of the method described in Tai and that of applicants' invention,

is that Tai deals with transportation of particles, in air. This is not possible in applicants' claimed invention. Throughout Tai mention is given to "airborne particles" (e.g. page 9, line 20; page 12, line 31; claims 16 and 32) or to the EPT system "operating in air" (page 11, line 9) or to electrodes exposed to air (page 16, line 6). Claims 3 and 11 of Tai concern the method of electrostatically transporting a particle through a medium, wherein the medium is air. In claim 10 the medium is a gas. It is well known to one skilled in the art of dielectrophoresis that particles cannot be transported by traveling wave dielectrophoresis through the medium of air because the particles will be attracted to and trapped at the electrodes under the action of a positive dielectrophoresis force. This occurs because all solid matter has a dielectric polarizability greater than that of air, and will experience a positive dielectrophoretic force driving it towards regions of high electric field strength. Such high field regions can only occur at the edges of electrodes and they do not occur in free space. For a particle to exhibit traveling wave dielectrophoresis it must first be levitated above the electrodes by a negative dielectrophoretic force.

Accordingly, Tai does not teach the claimed DEP cell or dielectrophoretic method. Further, Tai does not provide any suggestion to modify the teachings therein to obtain applicants' claimed invention. Withdrawal of the §102 and §103 rejections based on Tai is respectfully requested.

As to Pethig '355, Pethig '355 discloses a method for characterizing or testing particles using an electrode array energized with a frequency spectrum of stationary dielectrophoretic fields. Pethig '355 does not teach transporting and separating particles along an electrode array using traveling dielectrophoretic fields to which applicants' invention is directed. The method and electrode shape described in Pethig '355 would neither produce a translational force directing particles across the electrode, nor permit the selective separation of particles as in applicants' claimed invention. Pethig '355 does not describe or show in the figures the providing of a channel as claimed by applicants. Rather, Pethig '355 describes a method whereby differing particles may adopt differing positions on a DEP array, there only being a defined end point for each particle type but no defined route by which

particles may travel and thus no generation of a particle channel as claimed by applicants.

Accordingly, Pethig '355 does not teach each and every element of the claimed invention. Further, no suggestion is provided therein to modify the described apparatus or method so as to obtain applicants' claimed invention. Withdrawal of the §102 and §103 rejections based on Pethig '355 is therefore respectfully requested.

The literature reference of Talery describes the transport and separation of particles by traveling wave dielectrophoresis along fluid channels that run between offset electrode elements (see Figures 2, 3 and 4 of Talery). The electrodes are designed to create traveling wave dielectrophoretic forces, but cannot deflect particles that travel in opposite directions into separate paths and produce the effect of "traffic control" as results with applicants' claimed invention and described in the captioned specification.

Talery teaches providing channels rather than the generation of at least one particle channel as claimed by applicants. Thus, Talery does not teach each and every element of the claimed invention. Further, no suggestion is present to modify the teaching of Talery so as to provide

applicants' claimed invention. Withdrawal therefore of the §102 and §103 rejections are respectfully requested.

As to Becker, the spiral electrodes described in Becker can move particles either into the center of the spiral coil, or to the outer perimeter of the spiral electrode shape, under the influence of traveling wave dielectrophoresis. The spiral electrode geometry does not produce the effect of deflecting counter-moving particles into separate paths. Thus, Becker does not teach or suggest the generation of at least one particle channel as claimed by applicants. Becker accordingly, is not capable of providing the "traffic control" effect provided by applicants' claimed invention as described in the captioned application.

Accordingly, Becker does not teach each and every element of the claimed invention and does not suggest modification which would result in the claimed invention. Thus, Becker does not anticipate or render obvious the claimed invention within the meaning of §102 or §103. Withdrawal of the §102 and §103 rejections based on Becker is therefore respectfully requested.

Pethig '689 discloses a method for carrying out reactions between particles, suspended in a liquid medium,

through the action of traveling wave dieletrophoresis. The underlying physics of the method is thus the same as the method described in the captioned application.

However, Pethig '689 does not teach or suggest the generation of a least one particle channel. Pethig '689 teaches means defining on the substrate a plurality of interconnected channels and electrode arrays associated therewith. The distinction of such structural feature as compared to the claimed invention is evident in that the apparatus taught in Pethig '689 provides that similar or dissimilar particles travel along the electrode arrays in the same direction. Thus, for example, Pethig '689 describes how different particles moving in the same direction can be selectively separated or brought together by traveling wave dielectrophoresis using an electrode array geometry in the form of a junction. Pethig '689, however, does not teach applicants' claimed DEP cell or method which provides selectively isolating particles moving in <u>opposite</u> directions along electrode arrays. The concept described in the captioned application of the "traffic control" of particles is not recognized or possible based on the teaching in Pethig '689.

Thus, it is respectfully submitted that Pethig '689 does not teach each and every element of the claimed invention or suggest modification which would result in the claimed invention. Withdrawal of the §102 and §103 rejections based on Pethig '689 is therefore requested.

Reconsideration and allowance of the application are respectfully urged.

Respectfully submitted,

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By _____

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Attachment - Proposed Corrected Figures 1 and 9b